West Shore Railroad Pier 7 Grain Elevator
Hudson River & Pershing Road vicinity
West New York
Hudson County
New Jersey

HAER No. NJ-47

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
MID-ATLANTIC REGION NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR
PHILADELPHIA, PENNSYLVANIA 19106

HISTORIC AMERICAN ENGINEERING RECORD

West Shore Railroad, Pier 7 Grain Elevator

HAER No. NJ-47

Location: On the Hudson River and Pershing Road vicinity West New York, Hudson County, New Jersey

(The pier center line is approximately 3,150 feet upriver along the bulkhead line from the intersection of Pershing Road and the Hudson River. Pershing Road is in Weehauken, Hudson County, New Jersey)

Date of Construction: 1904-05

Architect/Engineer: Superstructure: George M. Moulton & Company, Chicago
Substructure: William J. Wilgus and H. Fernstrom, successive Chief Engineers, New York Central & Hudson River RR

Present Owner: ARCORP Properties, Pershing Road, Weehawken, NJ 07087

Present Use: Vacant

Significance: Pier 7 is significant as the remains of the last and largest grain elevator built by a railroad in the Port of New York. Its two million bushel capacity -- together with the 1.2 million bushel elevator on adjacent Pier 8 to the north, completed about fourteen years earlier -- gave the New York Central and Hudson River Railroad the largest storage facilities in the port capable of loading both ships and barges. The West Shore Railroad, subsidiary of the New York Central, operated both elevators at its large waterfront terminal in Weehauken and West New York, New Jersey. Although the Pier 7 substructure is demolished, the site retains substantially intact foundation and mechanical components unique among railroad grain handling sites at this port. Except for foundation pedestals at Pier 8, no fabric survives from any of the other such facilities which played an important role between c. 1870-1900 in capturing the port's once immense grain traffic from the Erie Canal. The slightly later construction of the Pier 7 elevator was the New York Central's ultimately unsuccessful response to changes in North American grain shipping patterns, changes which eroded the Port of New York's traffic share after c. 1890.

Present Pier 7 remains have regional port and railroad engineering significance, as well as important historical associations. The original elevator combined earlier use of rectangular grain bins and grain legs -- seen at all previous railroad elevators in the port -- with a concrete relieving platform foundation, steel columns supporting the superstructure, and steel-walled bins. Steel here replaced the heavier timber contruction of the earlier elevators, allowing for a Pier 7 foundation generally similar to that employed on contemporary, early 20th century railroad lighterage piers. The surviving foundation with its column bases, all resting on dense rows of pile bents, thus contrasts markedly with the earlier brick pedestals on pile clusters seen in the port only at immensely heavy wood framed elevators. The first electrically powered elevator in the port, Pier 7 also featured the first regional use of horizontal grain conveying machinery in railroad facilities, replacing an exclusive reliance on spouts and allowing for grain movement among bins and grain cleaning equipment. The lower elements of the conveying system survive, allowing for documentation of otherwise unknown elements of elevator operations. The remains of a wooden extension pier, along with the surviving track level, indicate original traffic patterns.

Project Information:

A. Agency: New York District, U. S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

B. Project altering Pier 7: New York Harbor Collection and Removal of Drift Project
Hoboken-North Bergen, New Jersey Reach

C. Documentation preparation:

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D. Dates of Preparation: Research and photographed July 1983-July 1984
Completed November 15, 1984

PART I. HISTORICAL INFORMATION

A. Physical History:

1. Date of erection: 1904-05, based on Irwin 1905 and Annual Reports of the State Board of Assessors of New Jersey 1904, 1905.

2. Architects and Engineers (from Irwin 1905):

Superstructure: George M. Moulton & Company, Chicago
Substructure: William J. Wilgus and H. Fernstrom, New York Central & Hudson River Railroad

3. Original and subsequent owners:

(References are in the Hudson County Register's Office, Jersey City, New Jersey)

1901 Deed, July 13, 1901, recorded in Deed Book 790, page 7. Guaranty Trust Company of New York to the West Shore Railroad Company.

The West Shore Railroad merged with the New York Central Railroad Company in 1952. The New York Central Railroad Company and the Pennsylvania Railroad Company merged in 1968 to become (after several name changes) the Penn Central Transportation Company.

1978 Deed, October 24, 1978, recorded in Deed Book 3264, page 64. Trustees of the Penn Central Transportation Company to the Penn Central Corporation.

1981 Deed, December 14, 1981, recorded in Deed Book 3338, page 645. The Penn Central Corporation, and Despatch Shops, Inc., to Romulus Development Corporation.

Romulus Development Corporation is currently known as ARCORP Properties.

4. Builder and contractors: (from Irwin 1905):

Builder: New York Central and Hudson River Railroad
Substructure: Bernard Rolf
Superstructure & Equipment: George M. Moulton & Company

5. Original plans and construction: Extant plans date to 1901. The facility completed in 1905 included the grain elevator and wooden extension pier described below, although some of the shipping and loading spouts were evidently not installed or completed until 1912-14.

6. Alterations and additions: The railroad built a dryer house at the landward end of the facility in 1931.

7. Demolition: Demolition and/or equipment removal in 1968 included all components above the first floor deck or track level, virtually all track on that level, and the dryer house.

B. Historical Context:

Although New York City was a center of American barrelled flour exports to the Caribbean and, later South America beginning in the late seventeenth century, shipping of unmilled grain remained limited before the repeal of the British Corn Laws in 1846 quadrupled bulk grain exports through the Erie Canal and the Port of New York. All documented grain handling facilities in the port date to between c. 1846 and 1922, from the first appearance in floating grain elevators and grain stores with stationary elevators in Brooklyn to the erection of the Gowanus Bay grain elevator at the New York State Barge Canal terminal. The masonry stores of Brooklyn, all completed in c. 1880, comprised virtually all of the port's grain storage facilities until the mid 1870s, when railroads began to capture the Erie Canal trade. Between 1876 and 1881, the New York Central, Erie and Pennsylvania railroads built four large grain elevators in Manhattan and Jersey City, with total storage capacities of about 5.3 million bushels, while the Lehigh Valley Railroad built two much smaller transfer house or working house facilities in Perth Amboy for short term storage prior to barge loading. Both the limited shiploading capability of the railroad facilities -- only the Erie and Pennsylvania elevators featured deep water access -- and the small railroad storage capacities relative to the port's total traffic, prolonged the lives of the Brooklyn stores until c. 1910. The port's declining share in grain exports after c. 1890, and the railroad's increasing use of canal boats for temporary storage prior to transfer to liners, eventually eliminated the stores' post-1880 function of holding railroad-handled grain. Floating grain elevators, which loaded ships from lighters or barges, remained an important if shrinking component of the port's grain traffic until the end of such traffic by the 1960s; the great size of the harbor required these exotic craft in the absence of much grain shiploading facilities (Albion 1939: 76-94; Anonymous n.d.; Fuerst 1978; New York, New Jersey Port and Harbor Development Commission 1920: 414-16; Raber, Flagg, Parrott et al. 1984: 95-110; Scientific American 1897).

There was almost no additional railroad storage capacity added betwen 1881 and the completion of Pier 7 in 1905, with the only elevators built during this period being replacements for the New York Central and Lehigh Valley facilities which burned in 1889 and 1899, respectively. The New York Central's first elevators -- A and B at the 60th Street yards on Manhattan's West Side -- served only barges, lighters, and onshore drays. To compete with the Erie and Pennsylvania shiploading capabilities, the Central chose not to rebuild one of the two West Side elevators burned in 1889, instead building a superstructure on the 1883 foundations of the uncompleted West Shore Railroad elevator at the Weehauken terminal. The Central acquired the West Shore in 1885. The foundations at Pier 8 already had a dredged channel along one side sufficient for ships when the Central began construction (Raber, Flagg, and Levin 1984: 55-56; Raber, Flagg, Parrott et al. 1984: 106-107).

The Pier 8 elevator did not substantially increase the Central's storage capabilities, reflecting the general unwillingness of railroads in the port to expand their earliest grain facilities until the twentieth century. Conditions contributing to this lack of development included railroad rate structures designed to capture grain traffic for the Port of New York regardless of facilities, and limited available water frontage after several decades of intensive railroad terminal constructon. Train export in mixed liner cargoes was a particularly important factor, since the custom of "free lighterage" within the port from tidewater terminals to local points of distribution and transhipment allowed liners to dock anywhere in the port and receive varied cargo, thus encouraging grain facilities designed for barges and lighters. By the early twentieth century, however, federally mandated rail rate differentials favoring Baltimore and Philadelphia increased shipment of full cargoes, and new facilities for shiploading at these and other ports -- notably Montreal -- left the railroads at the Port of New York in a far less faborable position. The New York Central's construction of the Pier 7 elevator at the West Short terminal by 1905 was one response to this situation, giving that line more grain storage capacity suitable for shiploading than all other lines in the port combined. Faced with demands for more shiploading facilities and less reliance on long term storage prior to eventual shipping, however, the railroads in the port made few other changes. The Erie dredged along its 1880 Jersey City elevator for ship access in 1913, but the Pennsylvania built a new facility at Philadelphia and tore down its Jersey Ciy elevator c. 1918. New York State's competition with the railroads for port grain traffic, in the form of much lower storage rates at the Gowanus Bay elevator completed in 1922, simply exacerbated the port's grain problems by further discouraging new railroad facilities while failing to provide adequate shiploading capability. Thus, the port became less competitive, even with the benefits of tremendous post-World War I Canadian grain exports. With the almost simultaneous completion of a very large elevator at Albany, imposition of high Canadian grain duties, and the onset of Depression conditions in the early 1930s, New York's traffic plummeted until after World War II. By the time of an uneven revival of grain handling via idle Liberty ship storage, c. 1947-65, all railroad elevators other than the Central's

Pier 7 were burned or demolished. The demolition of Pier 7 in 1968 left the Gowanus Bay elevator as the only sanding grain facility in the port (Anonymous n.d.; New York, New Jersey Port and Harbor Development Commission 1920: Chapter 29; Raber, Flagg, Parrott et al. 1984: 109-24).

All large grain facilities in the port other than the Brooklyn stores generally followed Midwestern developments in elevator design. Most of the grain stores featured partially documented conveying equipment and storage bins added onto multi-story masonry spaces originally designed for general cargo storage. In contrast, the large specialized grain elevators built in the port between 1876 and 1905 all had dense vertical arrays of rectangular storage bins topped by cupolas fitted with equipment for weighing grain and distributing it to the bins. Volumes enclosed by the bins, and by the lowest floors of the elevators where grain entered the structures or fell for inter-bin movement, ranged between 325-400 x 70-100 feet in area and 60-100 feet in height. Cupolas and grain distribution floors above the bins usually ran the lengths of the elevators and rose an additional 50-100 feet. All of the nineteenth century railroad elevators featured the dense arrays of masonry pedestal foundations, usually on wooden pile clusters, seen in the Midwest; timber columns on the pedestals supported generally all-frame structures. Although galvanized iron and slate faced some of the elevators completed before 1882, with a shift to brick and tile facing on the 1890s structures, the wooden elevators were spectacularly susceptible to fire. Pier 8's lower floor of brick, with tile sides above, was the most significant local response to this hazard before the construction of Pier 7 in steel, brick, and concrete. The all-concrete, circular bins at Gowanus Bay, topped by two steel-framed, cement-plastered cupolas, completed the gradual changes in elevator design and material emanating from firms in elevator centers such as Chicago and Minneapolis (Ketchum 1907; Raber, Flagg, Parrott et al. 1984: sections VIII and IX).

Handling equipment in the railroad and Barge Canal elevators also followed Midwestern practice, although the use of pneumatic elevating machinery never appeared in this port. Instead, grain legs or elevators with metal buckets on canvas or rubber belts lifted grain from the lowest to the highest levels of all these facilities, and unloaded barges or lighters from exterior marine towers when hung in yokes and fitted with hoisting gear. At the railroad elevators, grain cars unloaded into hoppers or tanks below the bins for elevation to the cupolas for distribution to the bins. All grain elevators in the port prior to Pier 7 relied entirely on spouts below the hoppers and scales in the cupolas to make this distribution, but at Pier 7 and the later Gowanus Bay facility, horizontal belt conveyors below the hoppers and scales and below the bins allowed for more complete inter-bin transfers (Irwin 1905; Raber, Flagg, Parrott et al. 1984: section IX).

Although all the Port of New York elevators except the badly located Gowanus Bay facility -- which lacked rail connections -- featured some adaptation of Midwestern design to tidewater conditions, Pier 7 had the most exclusively local elements. The railroad elevators each had somewhat unusual wooden piers extending beyond the elevators proper to store unloaded cars and to tie up barges or ships awaiting service. In addition to this marine feature, Pier 7 also had a poured concrete, relieving platform foundation, described below, which derived far more from local developments in railroad pier design than from the pedestal column supports used previously (Raber, Flagg, Weigand and Antici 1984).

PART II. ARCHITECTURAL AND ENGINEERING INFORMATION

A. General Statement:

1. Character: Demolition and equipment removal in 1968 left partially intact remains of the grain elevator proper from the first floor or track level down, and the wooden extension pier. Equipment below this level remains in place. Debris from the demolished superstructure covers much of the western half of the surviving deck. A marine demolition contractor used the deck as a base of operations, c. 1983-83, while removing derelict barges along the ARCORP waterfront, and left a workshed on the deck comprised of welded barge sections. Photographs 1 through 6 document general site conditions in 1984.

2. Condition of fabric: The outer concrete bulkhead around the elevator is breached in many places, and remains in generally poor condition with the timber fender system consisting only of isolated piles (Photographs 3, 4, 5, and 11). Some breaches in the remains of the brick elevator walls have allowed for sedimentation in the basement, but all major foundation and superstructure support elements remain in place and in fairly good condition (Photographs 4, 8 through 11). All mechanical handling elements in the basement appear in place, including both types of hoppers or tanks described below, the horizontal conveyors with drive shafts and disarticulated belts, and the lower parts of the grain legs (Photographs 8, 9, 10, and 13). There are many large holes in the track level or first foor deck, but all chutes feeding the large receiving hoppers survive in good condition, along with many hatches or hatch openings once used to direct grain from bins above to conveyors and hoppers in the basement level below, and truncated grain legs (Photographs 2, 12, 13, and 14; Figure 2). Except between the eastern brick wall and the outer bulkhead, the rails which once brought cars over the receiving hoppers and onto the extension piers are gone (Photographs 3, 4, and 11; Figure 2). Although no longer physically connected with the elevator and partially

collapsed, most of the wooden extension pier is intact (Photographs 1, 5, 6, and 7; Figure 3).

B. Description of Original and Surviving Exterior and Framing:

1. Dimensions:

Elevator foundations and deck:	354 x 101.5 feet
Bulkhead:	366 x 126.75 feet
Present height:	7 feet above mean sea level
Original height:	106.75 feet above mean sea level to bin tops, 203.3 feet to cupola top
Original cupola area:	44 x 354 feet
Extension pier:	436 x 126.75 feet

2. Foundations: Elevator foundations, shown in detail in Photographs 15 and 16, include 3,842 spliced piles driven an average of 116 feet below mean low water in an dredged area about 126 x 390 x 8 feet below mean low water. Sand fills areas between piles to an elevation of one foot below mean low water. Above the piles, cut about 3 inches below mean low water, a Portland cement concrete surface rises at least three feet high and originally formed a continuous bulkhead wall around the elevator as well as piers for the elevator columns. There are eight rows of twenty-six piers on fourteen-foot centers. Perpendicular rows of steel rails reinforce the concrete above the piles. Sand fills spaces among the piers, at the top of which rest a concrete subdeck four inches thick. This relieving platform foundation has no exposed wooden components, and is highly fire resistant. The brick walls of the elevator rise from this level (Irwin 1905).

The extension pier, shown in plan in Photograph 1 and Figure 3, is an all-wood structure supported by pile bents about ten feet apart, with piles within bents on about five-foot centers. All piles are cut and capped at about mean low water, above which squared timbers support the deck of 9 x 3 inch lumber on 12 x 12 inch timbers (Photographs 6 and 7). The unusual "cut-outs" in the deck, common to grain elevator piers, define an avenue 45 feet wide coresponding to the rail lines running through the elevator, and two narrower areas used for vessel tie-up. The cut-out design remains unexplained in all sources consulted, but may be a means of isolating fires in unloaded grain cars from vessels. A partially intact six-inch water line runs along the north side of the northmost cut-out, resting on the deck supports and ending at a hydrant (Photograph 7 and Figure 3).

3. Walls: Common brick, 25 inches thick, formed the elevator walls to the tops of the bins. The brick was laid in cement mortar to a height of 32 feet above the subdeck -- where the bins began -- and in lime mortar for the 72.5 foot height of the bins (see Figure 4). These walls survive to a height of about four feet, and retain the bases of pilasters about 33 x 9 inches (15 on the eastern end wall) around structural steel columns (Photographs 3, 4, 8, and 11). The walls of the cupola were eight-inch partition tile (Irwin 1905).

4. Structural system: The elevator was framed entirely in steel, with columns rising from the concrete piers on fourteen-foot centers. The middle four-column rows extended to the top of the cupola (Figure 4). Figure 2 includes undocumented details of the steel supports for the track deck, also shown in Photographs 8, 9 and 10.

5. Exterior bulkhead and fender system: The outer edge of the concrete foundation formed a now-badly deteriorated bulkhead with a semi-pyramidal section five feet wide at the base, three-feet wide at the top, and about eight-feet high. As shown in Photograph 14, 12 x 12-inch sheet piling surround the substructure below the outer edge of the bulkhead; present sheet piling conditions remain unclear. The plan shown in Photograph 15 also details the now-largely non-existent sand lining and concrete deck between the bulkhead and the brick elevator walls. Photographs 3, 4, and 5 show present bulkhead conditions including the limited pile remains of the timber fender system.

6. Openings: The only known openings, shown in Irwin 1905 and in New York, New Jersey Port and Harbor Development Commission 1920: 415, were two car doors at each end of the elevator, a pedestrian door in a stair and elevator tower at the upland end of the elevator, and ducts or vents in walls between the exterior columns. Steel doors covered all openings (Irwin 1905).

7. Roof: Figure shows roof profiles. Roof coverings consisted of 3-inch book tile laid on T-shaped iron supports, and covered with pitch and gravel finished in asphalt and gravel coating (Irwin 1905).

C. Description of Original and Surviving Interior:

1. Floor plans and functions: There were originally eight floors defining nine functional levels. Only the lowest level and the lowest two floors remain. Figure 4 shows the original levels in section, described below from the bottom up.

a. Subdeck: Resting on the foundation piers, this floor featured column supports, drainage gutters, eight horizontal conveyors, and the tops of all twenty-three grain hoppers resting on concrete lips. Each hopper contained the lower end or boot of a grain leg. The concrete foundation above the piles entirely contained the fifteen smaller hoppers, but the eight receiving hoppers dropped below the heads of the piles. The means by which the builders supported the steel receiving hoppers in a waterproof manner remains an important, but currently unknown detail not shown in any available data (Figure 2, Photographs 8, 9, 10, 15, 16, and 18).

b. First floor or track level: At the same height as the extension pier, this level had two sets of tracks running over chutes into the large receiving hoppers, nuimerous hatches allowing for grain movement from the bins above to hoppers or conveyors below, fourteen grain separators with cleaning machinery run by seven 40 h.p. motors, two 40 h.p. motors running the eight conveyors on the level below, plus undocumented car re-loaders shovel machinery for unloading, and a car puller. There were offices for weighmaster and a foreman, and a switchboard room, on this level although available plans are incomplete regarding room locations (Figures 2 and 4, Photographs 2, 4, 12, and 18; Irwin 1905).

c. Bins: The bins began twenty-seven feet above the track level, and through spouts which have not survived could be emptied into the hoppers in the subdeck. Car loading spouts, of uncertain arrangement, apparently alalowed for direct transfers from bins to cars after 1912. The 241 bins of varied sizes rose 72.5 feet, and consisted of steel plates five feet high, running the width of each bin, 5/16 to 3/16 inch thick from bottom to top. Bin capacities totalled 1.94 million bushels. Along the outer rows of bins on the long sides of the elevator, there were twenty-three shipping bins in the upper halves of alternating bays (twelve on the north side and eleven on the south), feeding by exterior spouts to grain barges, lighters, or ships (Figure 4; Irwin 1905; Conrail Microfilm MF032722).

d. Bin floor: This highest floor below the cupola had holes in the bin tops, fed from above by forty trolley spouts (Figure 4; Irwin 1905).

e. Spouting floor: At the bottom of the cupola, the space above this floor had fixed spouts set into the motor floor above and fed from the belt conveyor on that floor. The fixed spouts fed directly into the trolley spouts below (Figure 4).

f. Motor floor: The belt conveyor running the length of this floor along the central axis passed twenty-three 100 h.p. motores which operated the grain legs. A 60 h.p. motor ran the conveyor, while another 60 h.p. motor may have operated an undocumented dust collector (Figure 4; Photograph 19).

g. Scale floor: The central axis of this floor supported twenty-three steel plate scale hoppers, eight of which were 2000 bushel receiving hoppers while the remainder were 800 bushel hoppers for shipping, transfer, and cleaning (Figure 4; Irwin 1905).

h. Garner floor: This floor supported twenty-three 1600-bushell steel plate garners, fed from above by the grain legs and leading directly to the scale hoppers below (Figure 4; Irwin 1905).

i. Machinery floor: The highest floor in the cupola supported the upper pulley wheels and heads of the twenty-three grain legs or elevators, machinery which carried grain directly from the bottom of the hoppers in the subdeck to the garners (Figure 4;l Irwin 1905).

2. Stairways and passenger elevators: Irwin (1905: 404) provides the only description of thess non-extant features, some of which are visible in Figure 4:

> "A brick stair tower on the land end of the building encloses a iron stair reaching from the first floor to the topmost floor of the cupola, and also a 5 x 6 foot passenger elevator of 2,000 lbs. capacity, with a speed of 75 feet per minute, which also operates to the topmost floor, with intermediate landings to the other floors. One spiral stair encased in an iron tower at the river end of the building reaches to the bin floor without intermediate landings. There are also several interior iron stairs reaching from the basement to the first floor and from the bin floor to the various floors of the cupola, and one flight reaching to the roof."

3. Flooring: Except for the three-inch book tile bin floor, all floors were of Portland cement concrete with cement mortar top finish, six-inches thick at the subdeck and first floor, four inches thick elsewhere (Irwin 1905; Photograph 15).

4. Wall, ceiling, and column finish: Irwin's description (1905: 403) is all that remains of these vanished features:

> "The first floor columns and the exterior columns of the cupola are encased with three-inch book tile, covered with cement mortar. The foremen's and weighmasters' offices and the switchboard room are petitioned off with four-inch partition tile and have ceilings of three-inch book tile."

5. Original and Surviving Equipment and Hardware:

   a. Grain handling:

      i. Hoppers: Figure 2 and Photographs 10, 15, 16, and 17 show the size and arrangement of the twenty-three plate hoppers, the tops of which still rest above the subdeck of sixteen-inch high, one-foot thick concrete lips. Sheet iron chutes above the eight large receiving hoppers run from the track level above, and carried unloaded grain to these hoppers (Photograph 12). Of the fifteen smaller hoppers, eight served to feed grain legs or elevators used for shipping and seven served for internal transfer among bins for cleaning or other purposes; the identities of the shipping and transfer hoppers and elevators remain ambiquous (Irwin 1905).

      ii. Elevator or grain legs: The twenty-three fixed elevators survive in a disarticulated condition from the track level down. Each leg included a rubber belt two feet wide and sheet iron buckets, with the entire leg encased in sheet iron below the track level and at the upper end of the machinery floor of the cupola (Figures 2 and 4); Photographs 13 and 14; Irwin 1905). Figure 5 shows typical, contemporary arrangements for such equipment, as well as details probably similar to the twenty-fourth, mobile marine leg which does not survive. The marine leg, in its steel tower, unloaded grain barges and fed into the receiving hopper nearest the river end of the elevator (Figures 2 and 4).

iii. Conveyors: There were originally nine rubber belt conveyors, eight on the subdeck and one on the motor floor in the cupola. The 50-foot-long lower ones, made by the Webster Manufacturing Company of Chicago, included three-foot-wide belts and ran transversely across the subdeck to transfer grain from bins to eight of the small hoppers for elevation to the cupola. These survive with their drive shafts and drum wheels, arranged in two groups of four (Figures 2 and 4; Photographs 8 and 18). The nearly 350-foot-long conveyor on the motor floor received grain from the scale hoppers above, and dropped it into spouts for bin deliver below via two trippers (Figure 5; Photograph 19; Irwin 1905).

iv. Spouts chutes and hatches: No spouting equipment above the track level survives, but to judge from Figure 4 and some original drawings listed below, unlined holes in the track level deck, and at least one surviving spout above the subdeck, spouts were round, of jointed sheet metal, and of varying diameters. The survivng spout, feeding directly into the marine receiving hopper, is ten inches in diameter; similar spouts probably ran through the 11-inch-diameter holes in the track level deck, while larger ones ran through holes with 22-inch diameters. Quadrangular openings in that deck, usually three-feet square, lead to sheet iron chutes which fed diagonally into hoppers or onto conveyors. Wooden hatch covers encased in sheet metal, fragments of which survive, closed the quadrangular openings when the latter were not in use. The lack of any visible covers for the circular openings suggests permanent placement of spouts (Figure 2; Photographs 8, 12, 13, and 14).

v. Hoppers and garners in the cupola: As described above and shown in Figure 4, these fixed features distributed grain from the grain leg heads to the long belt conveyor.

vi. Separators and cleaners: Irwin noted fourteen compound shake separators, each with a capacity of 5,500 bushels/hour. Other than the apparent location of these machines with their 40 h.p. motors on the track level, we have no information on them. They were fed from above, and emptied into some of the small hoppers (Figures 2 and 4; Photograph 18). We have found no details of the drying apparatus added in 1931.

vii. Dust collectors: An unknown number of undocumented dust collectors, probably located on the motor floor, picked up dust by suction and disposed of it outside the elevator to eliminate a fire hazard (Irwin 1905).

viii. Bins: Described above.

b. Power: The elevator was entirely electric, powered by a coal-fired station built about 1,000 feet upland. The New York Central built the power plant at about the same time as the Pier 7 grain elevator, spurred into replacing their varied steam plants at the terminal shops and the Pier 8 grain elevator by the new elevator demands. All terminal facilities ran off the 1905 plant until about 1933 when the West Shore switched to purchase of commercial power (Irwin 1905; Engineering Record 1905; Conrail Microfilm MF013505).

The power plant ran forty-three three-phase induction motors in the elevator, all without brushes and designed to run on twenty-five cycles/second alternating current. Of these motors, twenty-three with 100 h.p. capacities ran the elevator legs; seventeen with 40 h.p. capacities ran the cleaning machines, car puller lower conveyors, marine leg and tower, and dust collector fans; two with 60 h.p. capacities ran the dust collectors and the upper conveyor; and a single 10 h.p. motor ran the passenger elevator. There were over 400 lights inside and outside the elevator (Irwin 1905).

c. Water: In addition to the water line noted above on the extension pier, there was undocumented interior piping for fire service with forty-eight outlets equipped with hoses on swinging racks (Irwin 1905).

D. Original Operation: Although never previously described in any systemmatic detail, most elevator operations emerge from the design and mechanical relationships outlined above. Grain entered the elevator either by car on two sets of tracks, or from barges via the marine tower. Hand-guided mechanical shovels unloaded the grain from cars into any of the eight large hoppers, while the marine leg fed into the easternmost large hopper through one or more spouts. When unloaded, the cars were pushed onto the extension pier for eventual removal back through the elevator after an entire trainload was empty. The grain rose from the bottoms of the large hoppers via the legs or elevators to the top of the cupola, from where it dropped into the garners and receiving scale hoppers for delivery to the storage bins via the upper belt conveyor, fixed spouts, and movable trolley spouts. Grain requiring cleaning fed from bins on the north

side of the elevator into the cleaning machinery, and then into some of the smaller hoppers in the subdeck for re-relevation and re-distribution to other bins via the cupola. To transfer grain from storage bins to the cleaning machiner, the shipping bins, or othe points,, spouts and chutes fed the grain into some of the small hoppers in the subdeck either directly or via the eight transverse conveyors. From these hoppers, the elevation and distribution processes noted above were repeated. Grain shipment from the elevator usually involved feeding grain barges or ships (the latter on the north side only) from spouts at the bottoms of the shipping bins, but in some cases it appears grain was reloaded into cars from the large receiving hoppers or from the bins via spouts. The receiving hoopers could apparently take grain from some bins above, via chutes and spouts, for reloading or perhaps internal re-distribution. The more usual pattern, however, probably included receipt from cars and delivery to ships or barges; the nature, number and distribution of elevator facilities makes this pattern plain.

Elevator articulation with the later drying facilities remain unknown. Drying houses were evidently rare or non-existent in earlier elevators at this port, the earliest one probably being at the Gowanus Bay Barge Canal terminal. When installed in elevators with capabilities for rapid and complete interbin transfers, such as Pier 7, driers reduced the danger of grain spoiling during storage.

E. Site:

1. General setting and orientation: Pier 7 was located south of Pier 8 and six other lighterage piers, two transfer bridges, and a local ferry, and north of six lighterage piers, four transfer bridges, and the West Shore ferry terminal. It paralleled all other piers at the West Shore yards. The slip south of the pier, shared by Pier 6, only accommodated barges and lighters. The 225-foot-wide slip to the north, shared by Pier 8 and dredged more deeply during construction of the earlier elevator foundations, handled ships as well as smaller craft. This slip was the only one maintained at New York Central grain facilities for ships. The terminal waterfront is in generally poor condition, with half of the piers ever completed now pile fields and the remainder lacking all sheds or handling equipment. Virtually all upland terminal facilities are destroyed. Pier 7 is one of a very few significant or potentially significant sites left at this complex, which is today a vast empty expanse with a few buildings and piers awaiting ARCORP's ambitious development plans for a small city (Raber, Flagg and Levin 1984: 45-83).

2. Historic landscape design: The West Shore Railroad terminal went through several major developmental stages, transforming a salt marsh below the Palisades known as Slaugh's Meadow into several hundred acres of level, filled waterfront and upland. In a complex series of corporate arrangements, the West Shore and Ontario Terminal Company began construction of a tunnel through the Palisades and other terminal facilities in 1881 for the New York. West Shore and Buffalo Railroad and the New York, Ontario and Western Railroad. The New York Central took over this bankrupt project in 1885, creating a new West Shore Railroad. Except for completion of the Pier 8 grain elevator in 1891, the new management added little to the original terminal before a major construction program begun c. 1900. Pier 7 was part of this program, which by about World War I created virtually all terminal components ever completed. All facilities rested on the filled marsh except a small residential complex for railroad workers. The terminal deteriorated rapidly after c. 1970, following discontinuation of most operations here by Penn Central (Raber, Flagg, and Levin 1984: 21-37).

PART III. SOURCES OF INFORMATION

A. Original Architectural and Engineering Drawings: Conrail has a file of all surviving New York Central/West Shore drawings on microfilm, the originals of which may be in Smithsonian Institution collections, although this is currently unclear. There are about a dozen drawings for Pier 7 in the microfilm collection, many of which do not illuminate the general design or operation of the elevator. Some plans shown were never built. Except for three drawings of spout details, this collection contains no information on the elevator operating equipment, designed and installed by the George M. Moulton Company of Chicago; the Conrail drawings general document components designed by the New York Central. Photographs 15 through 19 include the most useful of the microfilmed drawings, listed below with the photographs. Other drawings, in chronological order, include:

Pier 7 Elevator Riser, May 1904. Drawing 18069, Microfilm MF004868. Shows electric light and power wiring diagram.

Pier 7 Receiving Tanks, Januiary 1905. Drawings 29143, Microfilm MM037705. Shows reinforcement arrangements for both types of hoppers, despite the title.

Pier 7 Grain Elevator. Connection for Shipping Spout. Marsh 1906. Drawings 33287, Microfilm MF037182. Although of interest for depicting loading arrangements from shipping bins, the microfilm is not sharp.

Pier 7 Car Loading Spouts. April 1912 (installed 1912). Drawing 46928, Microfilm MF032722. The spouts were 72 feet long, but their arrangement is unclear.

Pier 7 Shipping Spouts. September 1914 (installed 1914). Drawing 54586, Microfilm MF032271. Shows spouts on the north side of the elevator.

Pier 7 Grain Facility. Proposed Annex and Shipping Bins. July 1929. Drawing 76331, Microfilm MF020471. This proposed addition to the outer end of the elevator was never built.

Wheat Washer, Pier 7. August 1928. Drawings 74687, Microfilm MF020468. Apparently never built.

Pier 7 Grain Elevator. Plan of switch room and other alterations to equipment and wiring. December 1933. Drawings 82315, Microfilm MF013505. Part of terminal change to commercial power usage; drive arrangements for grain legs as shown.

The Conrail collection, managed by Nicholas Catania, is located at Conrail Micro-Film Department, Room 1107, 15 North 32nd Street, Philadelphia, Pennsylvania 19104, 215/596-3511.

There is no readily available information on the George M. Moulton Company or its work, although the firm designed other railroad grain elevators on the Atlantic seaboard (personal communications, Charles T. G. Looney, July 1984).

B. Early Views: No unpublished historic views of Pier 7 appear imminently accessible in the public domain, but there are several published views clearly showing the elevator and its marine rail terminal environment at different times. As the published views are both available in large libraries and rather poor originals for reproduction, we list them here for reference in chronological order. Citations appear in the bibliography below.

1905 Interior photographs of all cupola floors, the spouting floor, and the track deck appear in Irwin 1905, along with a drawn bird's-eye view of the terminal.

1912. Photograph from southeast, water level, of piers 7 and 8. Figure 68 in New York City Department of Docks and Ferries 1912.

c 1919. Two photographs in New York, New Jersey Port and Harbor Development Commission 1920. On page 47, a view to the north taken from the bluff above Pershing Road shows Pier 7 in the distance amidst the tracks and piers of the terminal. On page 415, a view to the northeast from above the yards shows piers 7 and 8.

c 1920. Two coarse half tones in New York Central Lines 1921. On page 747, a view from the water looking northwest of Pier 7. On page 750, an aerial view looking southwest showing both grain elevators and the north half of the terminal.

c 1925 Aerial photograph looking southwest showing both elevators and the south half of the terminal, in U. S. Board of Engineers for Rivers and Harbors 1926.

1940. Photograph of west elevation of Pier 7, on page 389 of Stauffer n.d.

c 1953. Photograph looking east from the bluffs, centered on Pier 7, on pages 132-33 in Feininger 1954.

Undated. Photograph looking northeast from the bluffs, on page 49 in Eickmann 1948.

C. Interviews:

Nicholas Catania, Conrail Micro-Film Department, 15 North 32nd Street, Philadelphia, PA 19104. July 1984.

Charles T. G. Looney, National Museum of American History, Smithsonian Institution, Washington, D. C. 20560. July 1984.

William Wehner, Engineer, Bridges & Buildings, Conrail, 15 North 32nd Street, Philadelphia, PA 19104. July 1984.

D. Bibliography:

1. Unpublished sources:

Anonymous
n.d. Export Grain Through the Port of New York. Mss. on file, Burgess Collection, G. W. Blunt White Library, Mystic Seaport, Inc., Mystic, CT.

Raber, Michael S., Thomas R. Flagg, Charles Parrott, Roselle E. Henn, Jed Levin, and Ernst A. Wiegand
1984 Draft Report: Cultural Resources Investigations in Brooklyn Reach I, New York Harbor Collection and Removal of Drift Project. Mss. on file, New York District, U. S. Army Corps of Engineers.

Raber, Michael S., Thomas R. Flagg, and Jed Levin
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2. Secondary and published sources:

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1948 History of West New York, New Jersey. West New York: Golden Jubilee Committee.

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1905 The New Weehauken Railroad Terminal Power Plant. Vol. 52, 20: 553-57.

Feininger, Andreas
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Irwin, J. C.
1905 The Weehauken Elevator of the New York Central & Hudson River Railroad. The Engineering Record 51: 401-04. (An identical article by Irwin, minus the interior photographs, appears as Large Grain Elevator at Weehauken. The Railroad Gazette 38: 330-32.

Ketchum, Milo S.
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New Jersey State Board of Assessors
1904 Annual Reports of the State Board of Assessors of New
1905 Jersey. (New Jersey State Library).

New York Central Lines
1921 Industrial Directory and Shipper's Guide. New York: New York Central Lines.

New York City Department of Docks and Ferries
1912 Report on the Mechanical Handling Equipment of New York Harbor.

New York, New Jersey Port and Harbor Development Commission
1920 Joint Report with Comprehensive Plan and Recommendations. Albany: J. B. Lyons & Co.

Scientific American
1897 Handling the Grain Crop at the Port of New York. Vol. LXXVII, 21: 325-26.

Stauffer, Al
n.d. New York Central Later Power.

U.S. Board of Engineers for Rivers and Harbors
1926 Port Series The Port of New York. Washington: Government Printing Office.

E. Likely Sources Not Yet Investigated:

Possible records of the George M. Moulton Company and the Webster Manufacturing Company of Chicago, uncatalogued drawings of other railroad grain elevators designed by the Moulton company in the Smithsonian Institution, and midwestern grain trade journals for design context.

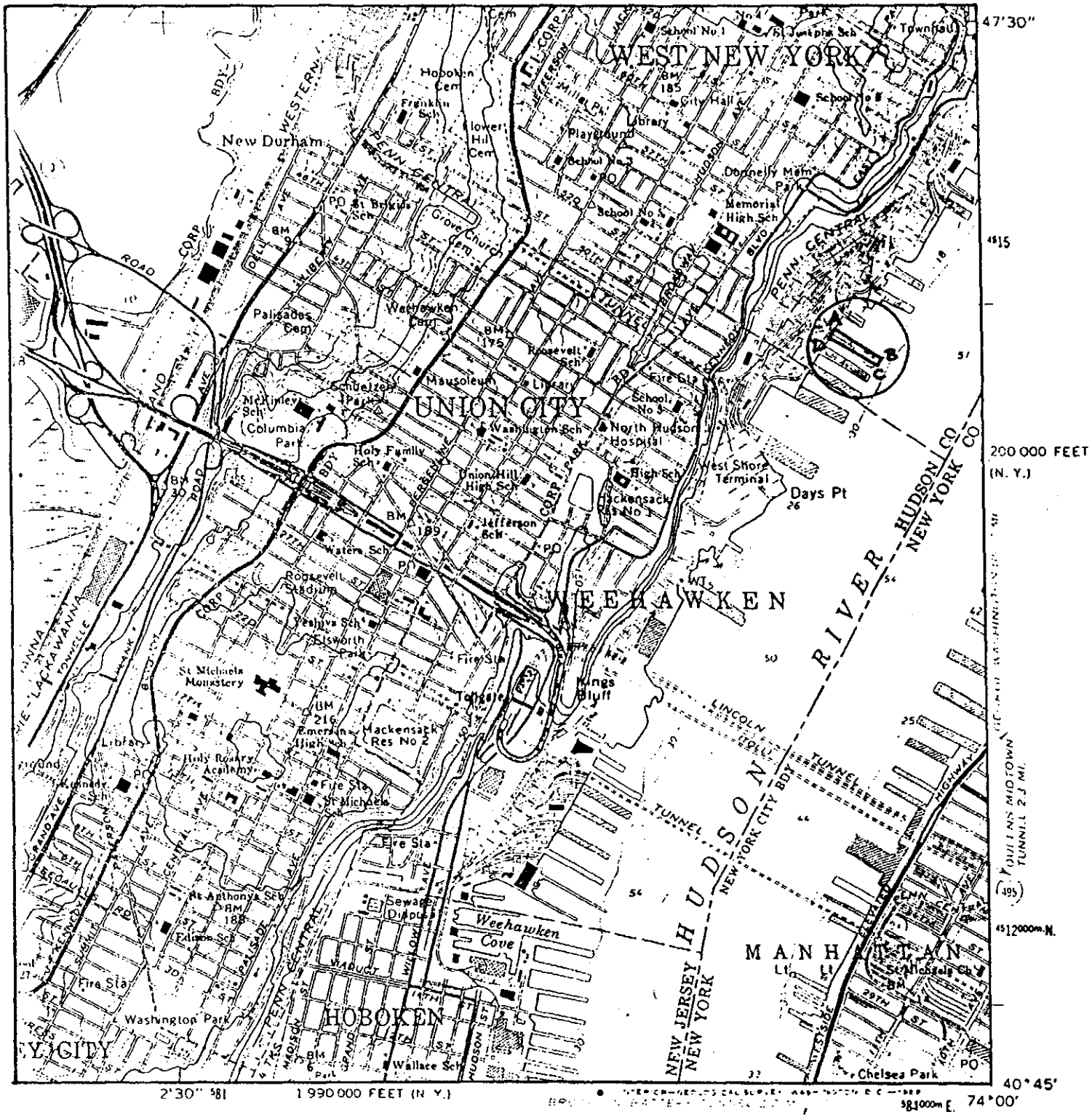


Figure 1. PIER 7 LOCATION AND UTM REFERENCES

Point	Zone	Easting	Northing
A	18	5 83 780	45 14 565
B	18	5 83 980	45 14 435
C	18	5 83 955	45 14 405
D	18	5 83 740	45 14 525

Weehawken, N.J. - N.Y. Quadrangle Sheet
1:24,000

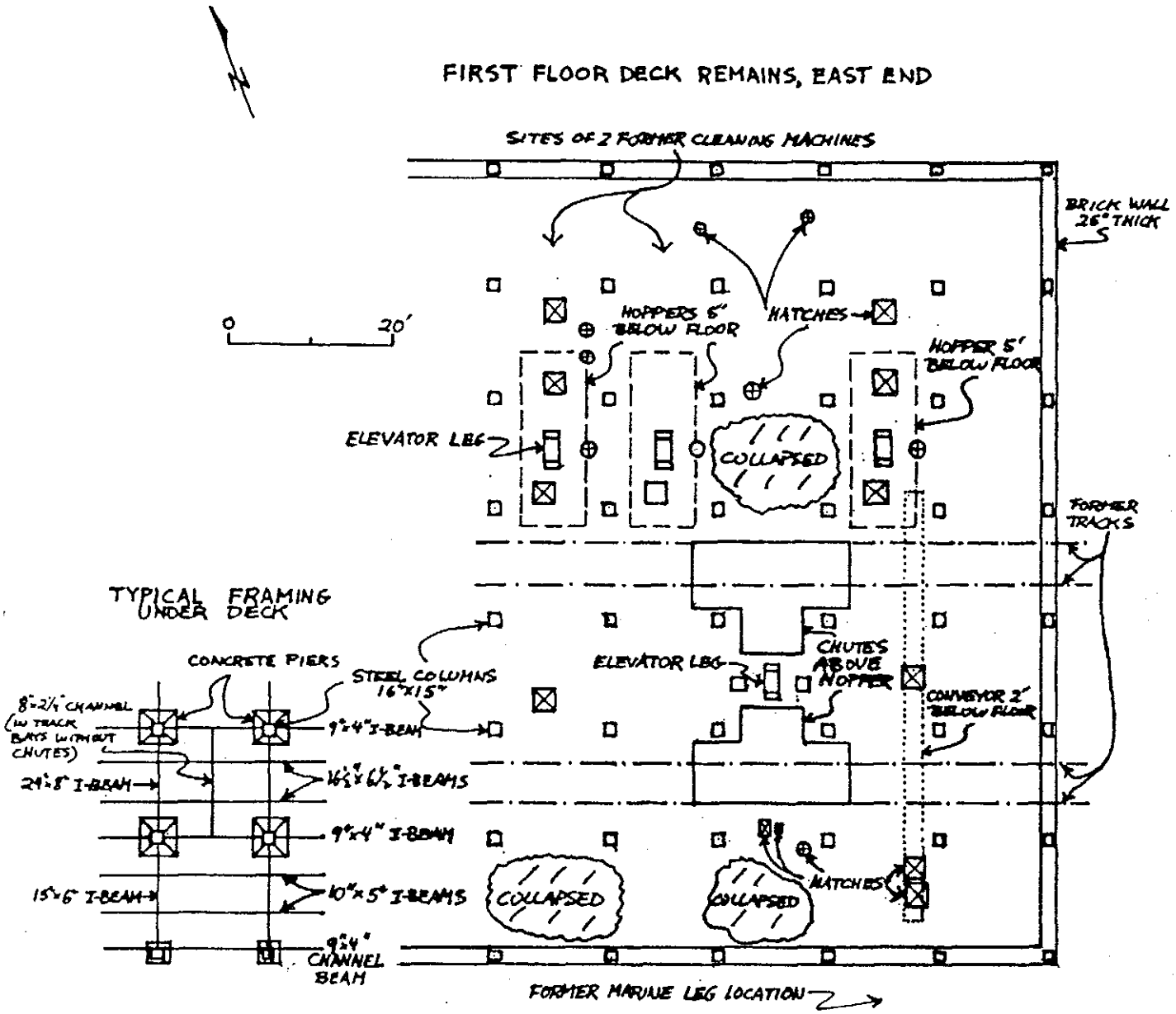


Figure 2. TYPICAL SURVIVING PIER 7 GRAIN ELEVATOR REMAINS
Drawn November 1984
Michael Raber

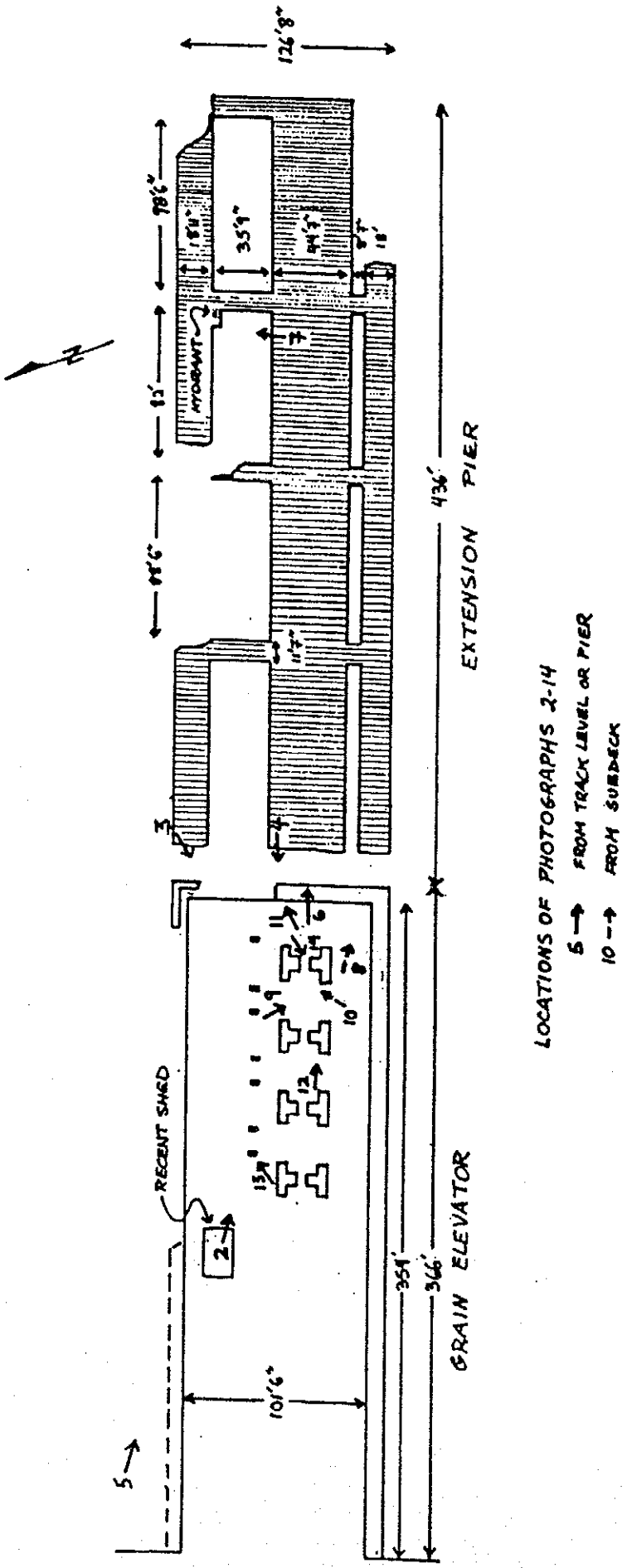


Figure 3. SKETCH PLAN OF REMAINS AT PIER 7, WITH PHOTOGRAPH LOCATIONS, JULY 1984
Drawn November 1984
Michael Raber

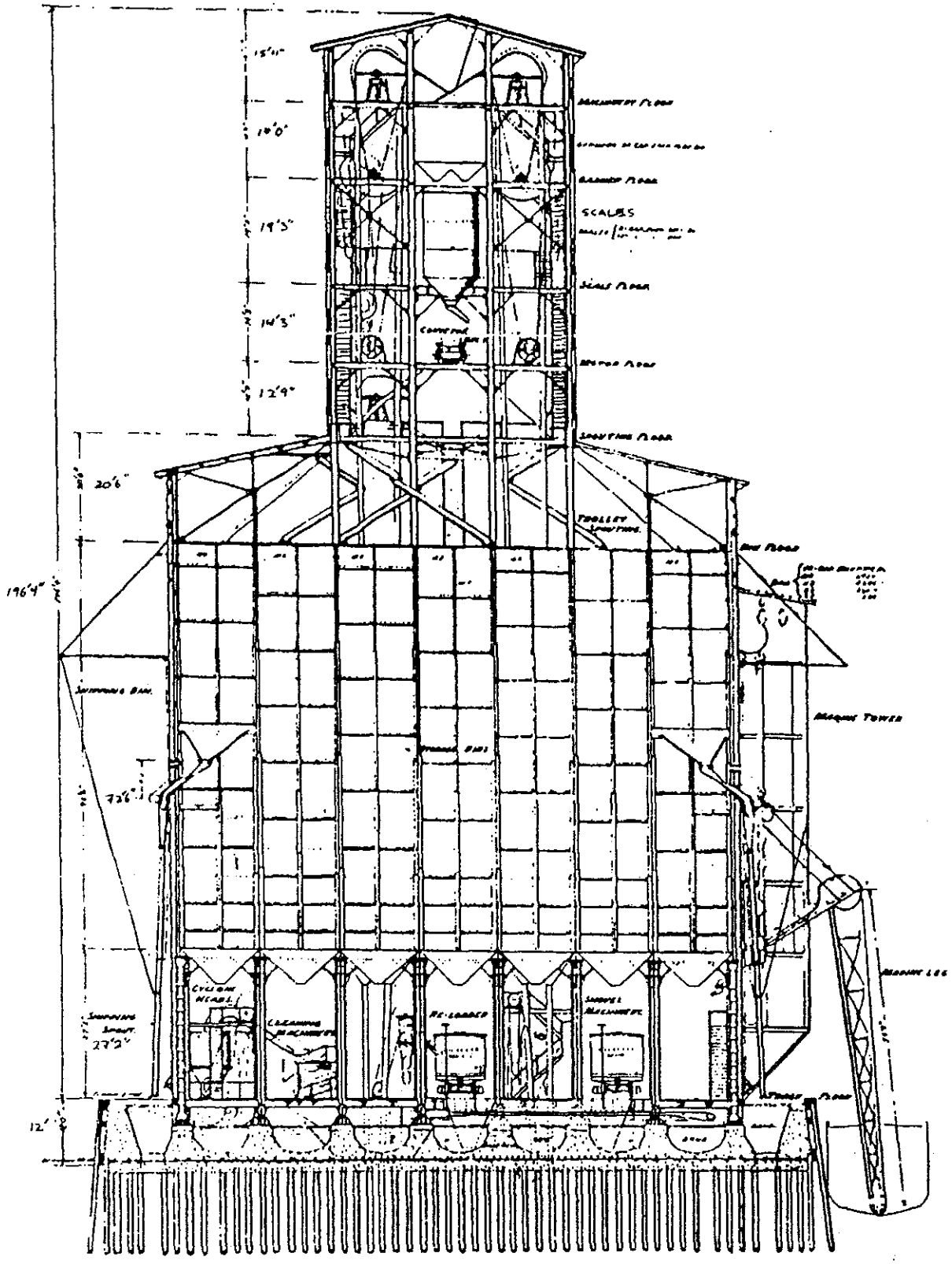
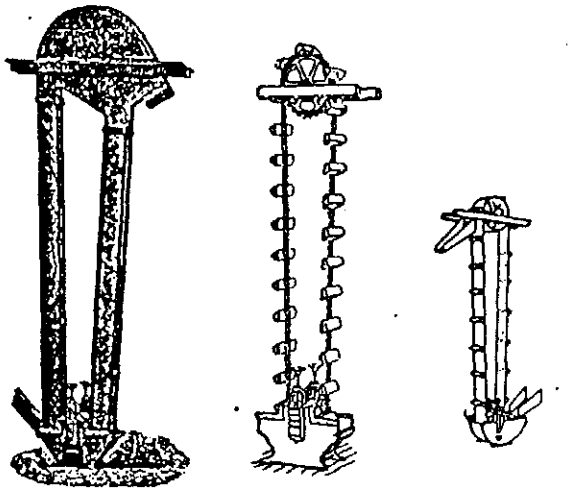
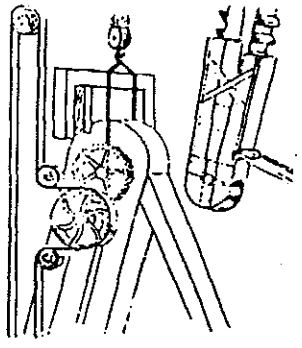


Figure 4. CROSS SECTION THROUGH PIER 7 GRAIN ELEVATOR AT MARINE TOWER
Source: Irwin 1905



ELEVATOR LEG. CHAIN ELEVATOR BELT ELEVATOR



2.—DETAILS OF ELEVATOR LEG.

belt conveyors

Figure 5. TYPICAL GRAIN CONVEYING MECHANISMS CONTEMPORARY WITH PIER 7

Top: Stationary Grain Legs (Source: Ketchum 1907: 214)
Middle: Marine Grain Leg Details (Source: Scientific American 1897)
Bottom: Belt Conveyors (Source: Ketchum 1907: 219)